Do Young Children Affect Travel Behavior for Parents in Atlanta?

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Option Paper

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Abstract

It is well researched that the physical environment can influence mode choices such as transit or walking. However, does having dependent children also play a significant role in mode choice?

This paper will investigate how having children five years old and younger can affect the travel behavior of parents in Metro Atlanta. Travel survey data from the Atlanta Regional Commission is used to delineate what variables lead to different mode choices, with specific attention to transit and walk trips in the region. Due to the significant role accessible child care facilities plays on the working population, spatial mapping is used to illustrate the distribution of child care facilities in the City of Atlanta. Finally, this report will highlight how gender plays an overall role in the travel behavior of parents and recommend policies to help offset associated challenges.

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Introduction

New Urbanism has been deemed as one of the most significant planning movements in the past century (Fulton 1996). Responding to the prevalent school of thought of decentralized and auto-centric suburban planning, the principles of new urbanism include high density, mixed use neighborhoods that encourage walkable, pedestrian-friendly street networks with access to other green transportation infrastructure such as transit and bicycle paths (Fulton 1996, New Urbanism, Yan Knapp 2003). Since the formal charter creation for the Congress of New Urbanism in 1996, support for New Urbanism has continued to grow with numerous chapters throughout the country.

Atlanta, generally identified as a sprawled metropolitan, is also starting to embrace the New Urbanism school of thought (Smart Growth America 2014, American Planning Association 2016). Four years after an initiative for transit-oriented development, the Metropolitan Atlanta Rapid Transit Authority (MARTA) now has six active transit-oriented development projects. Central Business Districts, such as Midtown, are quickly densifying as an increasing amount of development projects are announced within the 1.2-mile square mile district (American Planning Association 2016, Midtown Alliance). In 2016, Midtown was announced as one of the best neighborhoods in American due to its density, mixed-use and pedestrian friendly networks— the celebrated characteristics of New Urbanism (American Planning Association 2016).

However, how do these principles of sustainable transportation networks work with households that have young children? This report will explore whether or not having children will impact the use of alternative transportation modes, such as walking and transit. Will it effect women and men the same? National and local survey data is analyzed in a binary logistic

regression model to evaluate whether or not young children influence mode choice. Other variables, such as gender and urban form, are also utilized to identify and compare influence for walk and transit trips.

Literature Review

This literature review synthesizes seemingly different subjects to explain the travel behavior of parents in Metro Atlanta. Literature on the predictors of transit use and trip chaining were reviewed to illustrate traditional explanatory factors for transportation mode choice. Gender specific literature was also reviewed to understand the differences in the travel behavior between genders, which results in differences in child care responsibilities. One report in particular, research from Local Investment in Child Care (LINCC) regarding child care and transit in California, was utilized as a model for this report. The research from LINCC provided a framework for analysis by presenting a similar report that reviewed travel data in the Bay Area a decade prior. In totality, the literature brings together several explanatory factors for travel behavior to better understand the influencing factors for mode choice of parents in Atlanta.

A. Predictors of Transit Use

There is an extensive amount of literature that investigates how density and the built environment affects mode choice and transit ridership. For instance, free parking is shown to incentivize automobile use. Conversely, parking with an associated cost, often found in central business districts, encourages transit use (Cervero and Landis 1997; Shoup 2005). Atlanta, like many other major cities, includes a cost with parking in the central business district.

A study by Cervero and Radisch found that neighborhood design characteristics, such as dense, mixed-used pedestrian oriented design, are strong predictors for walking non-work

purpose trips. On the other hand, modal splits were relatively similar for work trips in their study — the study found that women were more likely to drive alone to work, despite neighborhood characteristics.

Other literature notes that there are higher transit shares in areas with convenience-oriented services. For instance, the presence of convenience stores or grocery stores near residences encourages transit use by allowing workers to shop while en route from transit to their homes (Cervero and Kockelman 1997). By providing services in mixed-use developments, there could be a decrease in motorized travel for these convenience-oriented services.

However, there is not a lot of literature specific to transit-use to child care facilities. If child-care could be considered a convenience oriented service like grocery shopping, then co-locating this service could theoretically decrease automobile travel.

B. Gender Contributors to Travel Behavior and Mode Choice

i. How Women Travel

With the rise of women in the workforce, there have been various studies that focus on how women and men differ in their travel behavior. From housing survey data to travel survey data, studies have shown that men and women have significantly different travel behaviors. For instance, women spend more time traveling on their commutes, yet their distances are shorter (Crane 2007, Rosenblom 1978).

This unusual combination could indicate that women are spending more time performing child-serving travel. Some studies indicate that eighty percent of women made trips solely for children, compared to fifty percent for their male counterparts. When the males did make child serving trips, they were infrequent and often served as a back-up alternative (Rosenblom 1988). In fact, even today, despite the seemingly strong advances in gender equality, women

consistently perform more child serving trips. A recent study using American Time Use Survey showed that there is a gender gap in child-serving trips between couples with no children, with women serving slightly more trips. However, the gap increases to its highest difference in couples with children, with women serving a substantial majority of the child serving trips (Taylor, Ralph and Smart 2015).

ii. Trip Chaining

Trip-chaining is generally defined as making multiple stops within one overall trip. For instance, one may start at home and travel to day care, travel from day care to work, then from work to the grocery store, and finally from the grocery store to their home. Each individual trip is a one-way segment of travel between an origin and a destination, making the previous example four separate trips. When multiple trips are used for one destination, they form a chain. In the literature reviewed for this report, chains are all trips between home and home or work and work.

Overall, women are more likely to trip chain on the way to or from work than men. Like the travel time survey, the difference between genders is small in households without children, but the gap increases in households with children. In households with children, women create more complex trip chains than the men. Moreover, single mothers of small children are more likely to trip chain than single fathers or mothers in two parent households (McGuckin and Murakami 1999). The higher amount of trip-chaining in women would explain the discrepancy between how much time women spend traveling, despite their shorter distance.

iii. Mode Choice

Trip-chaining is often explained as a means to save time by completing multiple trips within one trip-chain, as opposed to multiple individual trips (Hensher and Reyes, 2000). This time-saving also translates to the use of private automobile as a mode choice. Private automobiles

allow for more trips in a single journey, without the constraint of schedules and routes associated with public transportation. Therefore, trip chaining may contribute to a decreased use of transit and increased amount of automobile trips (Ye, Pendyala,Gottardi 2007).

The higher share of child care related trips for women could explain the difference in overall mode share split. To save time, women with children are more likely to travel by automobile to accomplish their complex trip-chains. Even worse, as women enter the workforce, trip-chaining activities are pushed toward peak commuting times (McGuckin and Murakami 1999). The challenge of time increases, forcing women to spent a greater amount of time commuting, at an increasing rate of three times that of men. While the research question calls into question how all parents travel, it should be noted that the secondary literature emphasizes the inseparable nature of child-rearing trips with women.

Methodology

Travel survey data was the primary source of information for this report. The detailed nature of survey data can answer complicated research questions due to its ability to brake down into specific trips made by travelers and associate them with characteristics of the household and the nature of the trips.

A. The National Household Travel Survey

The National Household Travel Survey (NHTS) is a survey collected by the U.S. Department of Transportation. The survey is collected every five to seven years to analyze the travel behavior of citizens throughout the United States. At the time of research for this report, the most updated version of this survey was from 2009.

The NHTS is a microdata dataset that provides detailed data by households, person, vehicle (travel day) level. The 2009 survey contains 150,147 households that were randomly selected through list-assisted random digit dialing (RDD) telephone numbers. Each household interviewed was then given a randomly assigned travel day and travel diary, where they recorded the details of the trips for the day. Since the data from this set was recorded nationally, it is used in this report to draw conclusions of travel behavior on a larger, national scale and does not take into account regional or local differences. To compare the national travel behavior to the local scale, a more detailed survey was required. The local metropolitan planning organization, Atlanta Regional Commission, provided the travel survey for the metro Atlanta region, which allowed for a larger regional sample size for analysis.

B. Atlanta Regional Commission (ARC) Travel Survey Data

The Atlanta Regional Commission conducted a regional travel survey in 2011 of the 20-county Metro region. This survey gathered characteristics of households in the following counties: Barrow, Bartow, Carroll, Cherokee, Clayton, Cobb, Coweta, DeKalb, Douglas, Fayette, Forsyth, Fulton, Gwinnett, Hall, Henry, Newton, Paulding, and Rockdale Counties. The final data set contains information for 10,278 households, of which 1,061 households also provided GPS data.

The travel survey information from both the NHTS and the ARC Travel Survey were analyzed in R Studio. Once datasets were combined on the trip, household and person level, specific variables were selected based on whether or not they could address how having children may affect mode choice for parents. Table 1 and 2 show which variables were used from the different data sets.

Table 1: ARC Travel Survey Variables

HHLIFE	Life Cycle
MODE	Mode
OTAZ	Origin TAZ
DTAZ	Destination TAZ
RESTY	Residence Type
OWN	Homeownership
HHVEH	Household Vehicle
AREAT	Area Type
LIC	License
GENDER	Gender
SCHOL	School
SMODE	Mode to School

Table 2: National Household Survey Data

LIF_CYC	Life Cycle
WHYTO	Destinations
WHYFROM	Origin
TRPTRANS	Mode Choice

For the NHTS, trip purpose was specified as day care. This allowed the data to be subset by *WHYTO* and *WHYFROM* to find exactly what mode households used to travel to day care. However, the ARC Travel Survey did not have day care as a specified trip purpose. Instead, the ARC dataset contained *SCHOL* as a variable, with day care as an option within this category. The ARC data also had a unique variable for mode choice to school, *SMODE*.

C. Binary Logistic Regression

This study utilized a binary logistic regression to determine what variable contributed to the probability of either a walk or transit trip. The model predicts the probability that the dependent variable will occur. In this study, the dependent variable is either a walk or transit trip. From the ARC travel survey data, seven variables were selected for the regression model. Six of the variables are dummy variables and *Income* served as the only continuous variable.

D. Spatial Analysis

To map the day care centers in Atlanta, all day care centers registered with *Bright from the Start*, Georgia's Department of Early Care and Learning, were geocoded. *Bright from the Start* works with child care agencies and organizations throughout the state to enhance early child care education. The site organizes and defines the facilities as three different categories: Child Care Learning Center, Family Child Care Learning Home and Other. The other category *Other* includes government-funded early care and education programs such as those operated by universities and technical colleges; military child care programs operated by the Department of Defense; some Early Head Start and Head Start programs; and early learning and development programs funded by Part B or C of the Individuals with Disabilities Act (IDEA) or under Title I of the Elementary and Secondary Education Act (ESEA).

The geocoded facilities were mapped over Travel Analysis Zones (TAZs) and mode choice frequencies. All survey data was originally subset and programmed through R studio, but later organized, cleaned and visually produced in ArcGIS. Travel Analysis Zones were used instead of census tracts due to the formatting of the data from Atlanta Regional Commission.

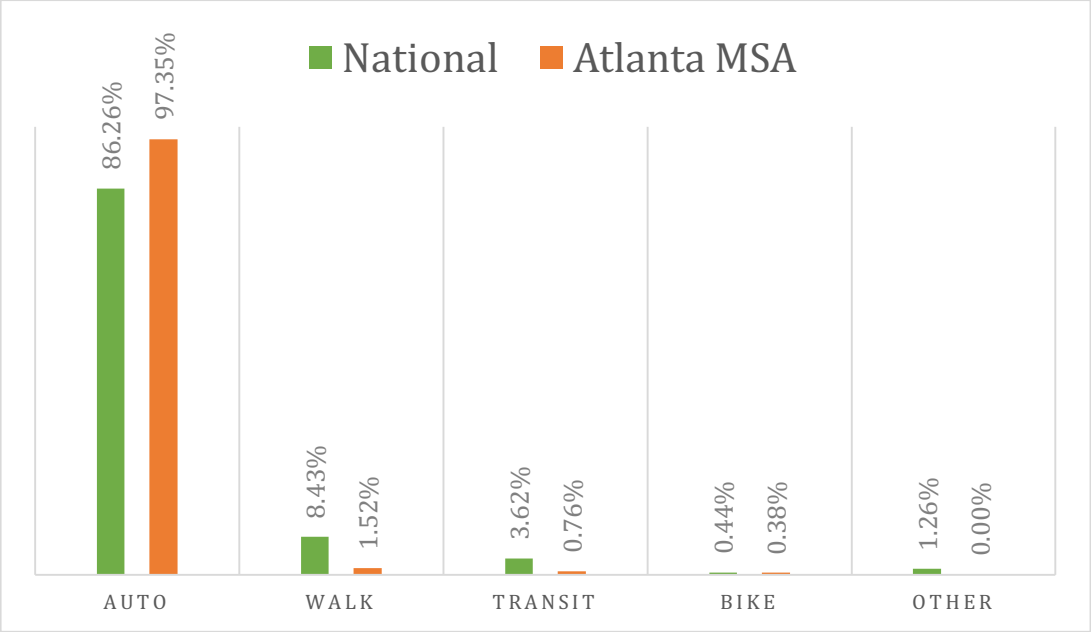
Findings

A. National Comparison

Travel survey data from both NHTS and ARC show that the automobile is the most prevalent mode choice for parents. Whether using it to travel to work or to day care, the automobile is the highest mode share at approximately ninety percent of total mode choice. However, Figures 1 and 2 differ slightly between how parents get their children to the child care facility and how the parents travel to work.

In Figure 1, the differences between the Atlanta MSA and the national data is the greatest. While the automobile still has the majority of the mode shares by a substantial percent on both scales, the Atlanta MSA is almost ten percentage points higher than the national scale. This in turn, forces the alternative mode choices, walking and transit, to take on fewer percent of trips. However, both the national and Atlanta MSA show walking as a more viable mode of travel to child care than transit. The results are surprising due to the fact that the Atlanta MSA is bias toward a more metropolitan region and does not account for as much of a rural population as the national data. This emphasizes that the Atlanta MSA is more car dependent than other regions. Additional explanation for this discrepancy could indicate that various reasons, such as the climate and built environment, affect alternative mode trip usage across different regions.

Figure 1: How do parents get children to and from child care?



Note: NHTS had a destination answer defined as Day Care under the variable WHERETO and WHEREFROM. The ARC Travel Survey Data defined Day Care within the SCHOL variable. However, the mode choice to school was defined as it's own variable, SMODE. SMODE was used to determine the mode choice to daycare in the Atlanta MSA.

However, how parents get to work is not always how they might travel to child care. In Figure 2, the differences between the national and the Atlanta MSA data is not as great. While the automobile is still the highest percentage, Atlanta has a few percentage points more than the national average. Unlike the previous comparison, this comparison shows that Atlanta has a higher percent of transit trips that walk trips. This could be indicative of the urban form of the Atlanta MSA. Unlike less dense regions, the Atlanta MSA houses a major rapid transit authority that could contribute to the higher transit trips.

Figure 2: How do parents with children under 5 get to work?

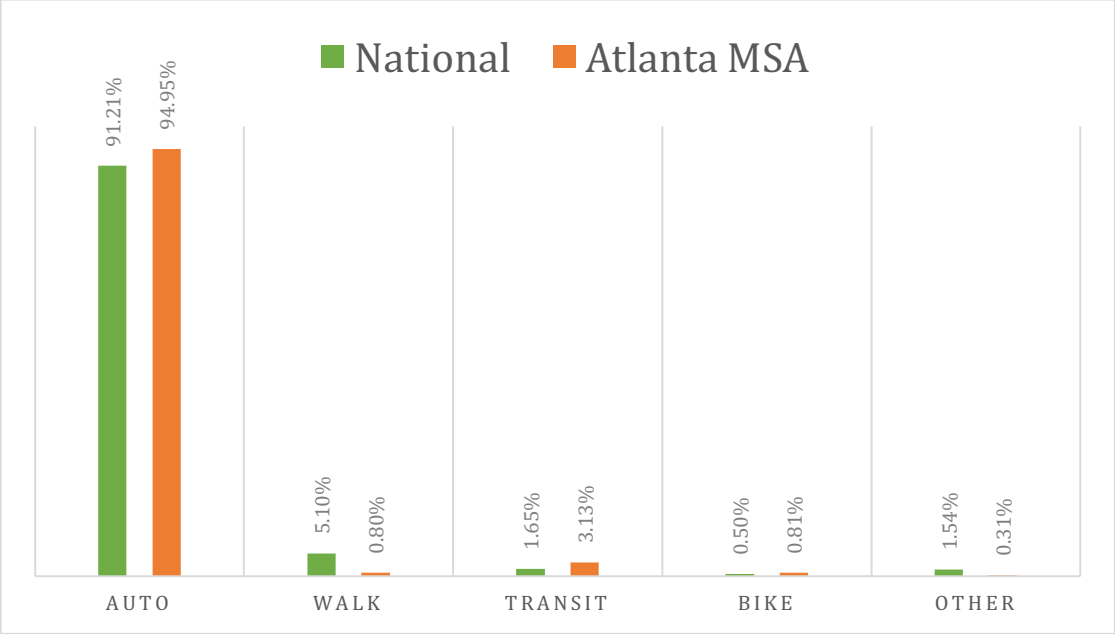
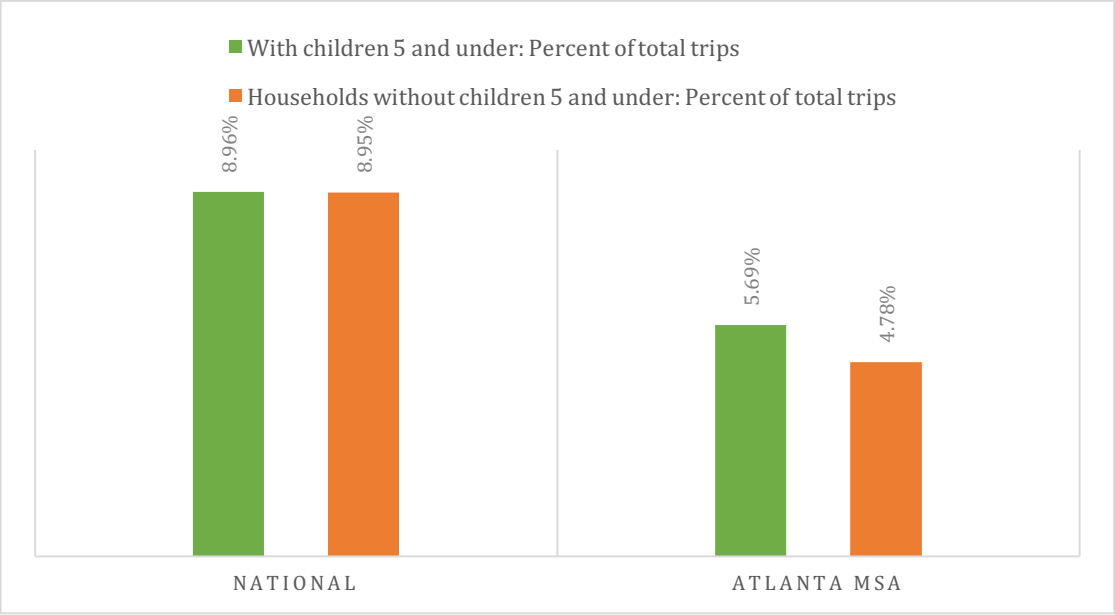


Figure 3: Do households with children 5 and under take less walk trips?



Lastly, Figure 3 deciphers how many of the overall trips, work and non-work trips, were walk trips. On the national scale, households with children five and under took approximately the same amount of walk trips as households without children five and under. While the Atlanta MSA shows an overall lower percentage of total walk trips, there is also a greater difference between households with dependent children and households without. The Atlanta MSA data suggests that households without children walk almost one percentage point less than households that do have young children. This suggests that households in Atlanta have an overall more difficult time taking walk trips, but when they do, households with young children are more likely to walk. Since the data is a collection of all trips, not just work trips, these trips could be convenience-based trips in the neighborhood. However, the data only shows whether or not the household has any children less than five and does not account for the number of children. The number of children could affect the total number of walk trips and is discussed in the following section.

Interestingly, the share of alternatives transportation modes increased for the Atlanta MSA when traveling to work, as opposed to the national survey data, which had an increase in automobiles. This result could signify that Atlantans have more accessibility to alternatives when traveling to work than they do to day care. The differences in the mode choice for parents' travel to child care versus work could also indicate some other things. First, the differences could account for all forms of child care. Even if parents do have children of a dependent age, they do not necessarily travel to a day care for child care. Second, the results more definitively indicate that not all parents trip chain work and child care. This could indicate that some parents either switch modes between trips, or that they travel to one destination or the other.

B. Binary Logistic Regression Model

A binary logistic regression model was run to determine what factors would contribute to the probability that a trip that was a walk or transit trip. The regression model was originally created to note whether or not there was any significance if the individual had a child less than five years old. While the results do indicate some connection between children in the household and walk or transit trips, they also strongly note the significance of urban form as well as the significance of variables that indicate access to capital.

a. Walk Trip

Of the the variables selected for the regression model, income was the only variable that did not show significance for a walk trip. However, income was also the only continuous variable — all others used in the model were dummies. Although all other variables in the model showed some significance, they differed substantially in strength and direction.

Two of the strongest positive correlations were directly tied to the urban form. *Residence type* was a variable in the data that identified housing as either single family-homes or a building with two or more apartments. The model shows that buildings with two or more apartments are positively correlated to an increased probability of a walk trip. The other urban form variable, *area type*, identified whether or not a location in the central business district contributed to a walk trip. The very low p-values for both variables indicate that increased density is likely to lead to a walk trip and that these urban form factors have more significance over the likelihood of a walk trip than other variables, such as household structure.

Gender was included in the model due to the connection drawn from the secondary literature. In the literature, women were shown to have higher trip-chaining and child care travel, which led to an increased dependency on the automobile (Rosenblom 1988, McGuckin and Murakami 1998, Ye et al 2007, Taylor et al 2015). The regression model showed that gender was significant and that males have a high likelihood of taking a walk trip. However,

surprisingly, the model also showed that adults in households with young children are also likely to take a walk trip. While these trips could be work or non-work, they show that having a child under five in the household will increase walk trips. However, if the number of children is greater than two in the household, the likeliness of a walk trip decreases.

Lastly, homeownership and access to a license negatively affects the likeliness of a walk trip. Homeownership indicates a direct access to capital, which would allow the person access to other resources, such as an automobile. Homeownship could also relate to the urban form and show that those who own homes are less likely to be in the dense central business district, where many walk trips occur. Non-surprisingly, homeownship and multi-unit apartments had a high negative collinearity of -.559 in the correlation matrix. Similarly, having a license could indicate access to a vehicle. In the correlation matrix, vehicle ownership was added as a variable and it had a correlation of -.429 with having a license. This access to a vehicle could show the significance that access to capital has on the probability of a walk trip. The more access to capital, the less likely a traveler will take a walk trip.

Table 3: Binary Logistic Regression Results for Walk Trips

INDEPENDENT VARIABLES	INTERCEPT	STANDARD ERROR	Z-VALUE	P-VALUE	SIGNIFICANCE
INCOME	-0.00006056	.00071716	-0.084	.9327	1
BUILDING WITH TWO OR MORE APARTMENTS	0.77266841	.05095173	15.165	<2.0E-16	0
HOMEOWNERSHIP	-0.070850932	.00071716	-14.598	<2.0E-16	0
HAVE CHILDREN LESS THAN 5 YEARS OLD IN HOUSEHOLD	0.2100985	.05095173	3.903	9.49E-5	0
HOUSEHOLDS WITH 2 OR MORE CHILDREN UNDER THE AGE OF 5	-0.09635005	.04853599	-2.011	.0443	.01
CENTRAL BUSINESS DISTRICT	1.86548459	.14425687	12.932	<2.0E-16	0
LICENSE	-1.85091057	.04465019	-41.454	<2.0E-16	0
MALE	0.15085254	.03428797	4.400	1.08E-5	0

b. Transit Trip

The regression model results for transit were not substantially different than the results for walk trips. The urban form variables, *building with two or more apartments* and the *central business district* continue to show a high probability of lending to a transit trip. Access variables, such as *homeownership* and a *license*, continue to show a negative relationship to the probability of taking a transit trip.

However, *income* and the household structure changed in this model. *Income* became significant, suggesting that income is more correlated with transit trips than walk trips. Household structure also changed in the model. While the model showed that having more

than one child decreases the probability of a transit trip, similar to the walk trip model, the significance increased in the transit model. Second, the significance of having children under five years old changes direction to a negative relationship for transit trips. These differences suggest that parents of children less than five years old are less likely to take a transit trip than a walk trip, but when their household increases in number of children, they are more impacted against taking a transit trip than a walk trip.

Table 4: Binary Logistic Regression Results for Transit Trips

INDEPENDENT VARIABLES	INTERCEPT	STANDARD ERROR	Z-VALUE	P-VALUE	SIGNIFICANCE
INCOME	-0.002473	.001147	-2.156	.0311	.05
BUILDING WITH TWO OR MORE APARTMENTS	.719322	.070355	10.224	<2.0E-16	0
HOMEOWNERSHIP	-.965162	.068754	-14.038	<2.0E-16	0
HAVE CHILDREN LESS THAN 5 YEARS OLD IN HOUSEHOLD	-0.231593	0.095531	-2.424	.0153	.05
HOUSEHOLDS WITH 2 OR MORE CHILDREN UNDER THE AGE OF 5	-0.445929	.082545	-5.402	6.58E-8	0
CENTRAL BUSINESS DISTRICT	1.358880	.188250	7.218	5.26E-13	0
LICENSE	-1.668612	.061185	-27.271	<2.0E-16	0
MALE	0.292948	.050244	5.831	5.525926E-9	0

c. Multicollinearity

While none of the variables overlapped in multicollinearity to credit removal from the model, there were some strong correlations between variables. As mentioned in the previous sections, the highest correlation was between *homeownership* and *buildings with two or more apartments*. If a household had a high probability of homeownership, the less likely it would be a multi-unit apartment. This suggests that the opposite housing structure is true—that the higher the homeownership, the more likely it is a single-family home. This correlation could represent various things. For instance, if homeownership and housing structure are highly correlated, then homeownership is a variable indicative of the urban form. However, homeownership also brings additional factors that the urban form can not identify. In this case, homeownership might indicate a less transient population with access to enough financial resources for purchasing a home.

C. Spatial Distribution

To illustrate transit accessibility, all known formal child care facilities were geocoded along the Metro Atlanta Rapid Transit Authority (MARTA) transit routes. Literature and Atlanta survey data suggests that people are less likely to walk to a destination if it is greater than a half-mile, but the likelihood increases with a decrease in distance (Canepa 1992, Lund 2003, Atlanta Regional Commission). A buffer was created around all rapid transit stations for a half mile, and another was created within a quarter mile. In Table 5, the breakdown of total day care facilities co-located with transit stations are listed in comparison to total facilities in the region.

Table 5: Child Care Facilities Near Transit

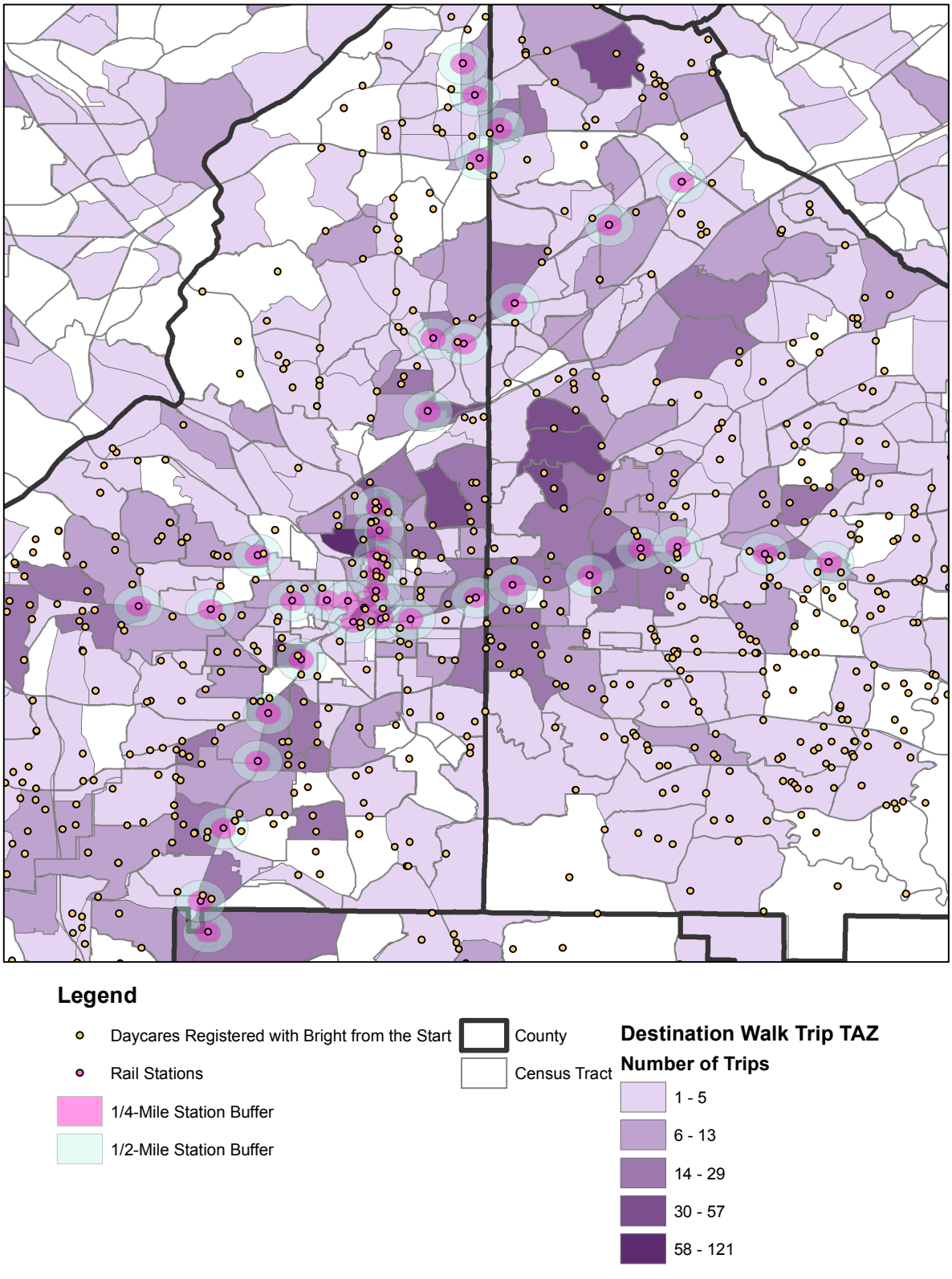
LOCATION	NUMBER OF FACILITIES
METRO ATLANTA	1218
CITY OF ATLANTA	255
WITHIN ½ MILE OF STATION	63
WITHIN ¼ MILE OF STATION	28

The geocoded facilities and transit system were layered on top of a walk frequency map organized by TAZs. Due to how the survey data was collected, destination TAZs were utilized as the geographic unit of measurement for the walk trips. The map highlights a few characteristics that were expected of the urban form. For instance, the central business districts of downtown and midtown have the highest frequencies of walking. Interestingly, there are also higher amounts of walk trips along MARTA's East transit line, despite a significant amount of residential land use in that area (MARTA). Lastly, while there are a large amount of TAZs with at least six walk trips along the transit corridor, there are also pockets of increased walk trips outside of the transit corridor. The data was broken into quantiles for mapping purposes, however, the low amount of overall walk trips, sampling bias and respondent errors make the details of the map hard to decipher. In general, the map serves the purpose of illustrating that child care facilities in walkable transit accessible do exist in Atlanta.

Finally, even if the facilities are co-located along transit facilities and there is a high amount of walk trips, the overall amount of parents who walk or use transit to child care facilities is still very low. This coincides with literature from LINCC, whose unique survey data

noted that a majority of parents use cares for their child care drop off and pick up, even if the facility was located near transit (LINCC 2007).

Figure 4: Transit and Walk Accessibility for *Bright from the Start* Day Care Centers



Recommendations

Improve Pedestrian Infrastructure

Despite the fact that the Atlanta Metropolitan Statistical Area contains various business districts and no rural areas, it averages a higher percent of automobile trips than the nation at large. Of the alternatives, walking has the largest difference from the national average. While walking in the Atlanta MSA is a low percentage of overall trips to child care for parents, the data shows that households with young children actually take more walk trips than households that do not. Therefore, despite the low walking accessibility, many households with young children take walk trips. This study recommends providing more pedestrian features for this demographic, such as maintained sidewalks that can support strollers used for dependent children. Pedestrian maintenance will help accommodate a demographic, parents, that are more likely to use this infrastructure.

However, in the City of Atlanta, many sidewalks are in a state of disrepair with curbs non-compliant with American Disability Act (ADA). To compound the problem, the responsibility for maintenance of these sidewalks are not well understood. In Atlanta, the sidewalk adjacent property owners are responsible for sidewalk and curb maintenance. Property owners are only required to take action when they receive notification by the City of Atlanta's Department of Public Works. Only if the property owner doesn't repair the sidewalk in a reasonable amount of time and provided there is funding, will the Department of Public Works make repairs and assesses the property owners for costs incurred providing (City of Atlanta Code of Ordinance).

A 2010 inventory report from the City of Atlanta estimated that eighteen percent of the City's 2,158 miles of sidewalks were deteriorated. While a small amount of infrastructure repair

is occurring, the Department of Public Works estimates that the replacement is offset by the increasing amount of deteriorating sidewalk as well as the increase costs to construct corrections (City of Atlanta 2011). These deteriorated sidewalks and non-compliant ADA curbs cause difficulty for many parents who walk with strollers and the current maintenance plan for these sidewalks obviously does not work. The City of Atlanta should assume responsibility for the maintenance, where they make active efforts to catalog and correct sidewalks before problem areas are addressed too late, if addressed at all (Carrillo et al 2012).

Focus Transportation Demand Management Efforts on Alternative Work Schedules and Teleworking

The data illustrates that the travel behavior for women, especially mothers, is distinctly different from other sectors of the population. It is therefore important to account for their unique travel behavior in transportation planning. Due to the increased dependency on the automobile for trip chaining child care related trips, women are often forced to spend a longer amount of time in the car despite their shortened work distances (Crane 2007). As the amount of women in the workforce remains strong, women are often forced into the most congested traffic hours surrounding office hours for these child rearing trips, increasing the time spent on child related household trips (Bureau of Labor and Statistics, Ye et all 2006).

Since most transportation demand alternatives are more difficult for mothers to use, such as transit, the more flexible alternatives should be highly encouraged and accessible for working mothers. Viable alternative transportation modes such as flexible work hours, compressed work week and teleworking would not only decrease traffic congestion, but would also engage a segment of the population that is generally averse to transportation alternatives due to time constraints. Transportation planners should therefore aim to increase implementation of these alternatives with major employers and regional plans, which may

require an increased proportion of transportation demand financing. While flexible work hours and teleworking are generally the most applicable and viable option for all commuting demographics, they are especially essential for parents in Metro Atlanta.

Create Discrete Variables for Child Care in Survey Data

The limited access to discrete child care and household structure data inhibited the full understanding of how parents travel. Although the data in this report utilized life cycle and some destination variables, the data remains too open-ended for any exact findings. For instance, the variable *life cycle* identified the household structure by the number of adults and youngest child in the household. For the Atlanta MSA, retirement is also noted, but it is only identified as an option for households without children. This data does not adequately identify the age break-down in the household or whether the adults are parents, or other family members. Greater specificity within the *life cycle* variable should provide greater clarity as to the number of parents in the household and their relationship to the children.

Moreover, within the ARC survey data, there was no available variable that specified a trip destination as either *child care* or *day care.* Instead, this report had to identify day care within the variable *School*, which was different from the trip purpose. This confusion lends itself to a less accurate telling of how parents travel to day care. It also does not provide a complete comparison to the national travel survey, which does provide *day care* as a trip purpose option. The Atlanta Regional Commission should add day care as a trip purpose and work to align the survey options to the national standard for greater comparison. An additional qualifier for the variable could also include the definition *child care,* to include informal forms of child care that would not otherwise be identified.

Conclusion

Before analyzing the travel data, it was no surprise that Metro Atlanta is a car-centric city. The tangle of highways intersecting the urban core expand miles into the circumference of the region, providing for a less dense, sprawled metropolitan. While Metro Atlanta is currently engaging in New Urbanism principles, the region remains more auto-dependent than the nation at large. This dependency is further highlighted by parents with young children and their low usage of alternative modes such as walking or transit.

While having children under the age of five does affect mode choice, it is the physical attributes associated with density, such as *residence type* and *area type*, that are most significantly tied to whether or not an individual takes a walk or transit trip. In fact, density and urban form are more significant to walk and transit trips than having a dependent child or having more than one child. However, having children under the age of five *does* have an impact on travel behavior, but differs between modes. Having dependent children negatively affects transit ridership, but positively affects walk trips. On the other hand, the number of children negatively affects both modes. For instance, if the number of children in a household is greater than two, the less likely a person will take a walk or transit trip.

Since having children under the age of five positively affects the probability of a walk trip, infrastructure should support this commute mode. However, the current status of the City of Atlanta's sidewalks and curb cuts are in a state of disrepair. In order to accommodate for the travel patterns of parents, the City needs to gain control of sidewalk maintenance and not leave the responsibility up to the adjacent property owners.

Gender is also a significant factor in mode choice. The binary logistic regression model showed that males are more likely to walk and take transit. When combining this with the

secondary literature that indicates that women are more likely to take on more of the child related trips, the results are not surprising. Since the automobile is often used to save time for child care related trip chaining, many mothers are not able to take transit or walk trips. By concentrating on transportation demand management efforts that focus on time sensitive alternatives, such as flexible work schedules and teleworking, working mothers will be able to decrease time and dependency on the automobile.

Finally, despite the significant role a dense urban form has on walk and transit trips, it may not be enough to encourage this mode choice for parents. Despite a number of transit accessible child care facilities, the percent of parents that use transit to the facilities is minimal. However, by co-locating of child care with transit, the facilities are also collocated with central business districts and denser regions. This density can provide parents with the ability to trip-chain child care with other tasks, albeit with an automobile. The data in this report indicates that the use of the automobile is by far the strongest utilized mode choice in Metro Atlanta and questions whether or not other options, such as transit and walk, could ever be a viable substitute. Further research with more discrete child care variables will be required to further track the difference young children has on the mode choice for parents.

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